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ABSTRACT

An integrated, three-dimensional cognitive model of reading comprehension was used to investigate the relationship between Piagetian theory (classificational reasoning abilities that emphasize the tacit use of metalinguistic concepts), and reading acquisition (word recognition and reading comprehension). Twenty-four second and third grade remedial readers were administered measures of classificational reasoning ability, word recognition, and reading comprehension. The results of a correlational analysis indicated that a small but definite relationship existed between classificational reasoning and reading comprehension and an almost negligible positive relationship between classificational reasoning and word recognition ability. The findings suggest that metalinguistic knowledge may be more applicable to reading comprehension than to word recognition activities. (FL)

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THE RELATIONSHIP OF CLASSIFICATION ABILITIES AND READING ACHIEVEMENT OF SECOND AND THIRD GRADE REMEDIAL READERS

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THE RELATIONSHIP OF CLASSIFICATION ABILITIES AND READING ACHIEVEMENT OF SECOND AND THIRD GRADE REMEDIAL READERS

Abstract. An interactive, integrated, three-dimensional Cognitive Model of Reading Comprehension generated hypotheses concerning the relationship between Piagetian theory, particularly classificational reasoning abilities with emphasis on tacit use of metalinguistic concepts, and reading acquisition. Twenty-four second and third grade pupils were referred and accepted for a remedial reading program. Pupils were administered Lowery's Classification Tasks, the Slosson Oral Reading Test, and the Silvaroli Classroom Reading Inventory. Results of correlational analysis suggest that a small but definite positive relationship exists between classificational reasoning and reading comprehension abilities. In addition, an almost negligible positive relationship exists between classificational reasoning and word recognition abilities. The higher percentage of shared variance between classificational reasoning and reading comprehension abilities contrasted with the variance shared between classificational reasoning and word recognition suggests that metalinguistic knowledge may be more applicable to reading comprehension than to word recognition activities. Lowery's Classification Tasks may predict reading comprehension ability in remedial readers.

There is a need for better understanding of the complex processes involved in reading acquisition and reading comprehension. A Cognitive Model of Reading Comprehension (Foltz, 1981) relating thinking level and reading acquisition was designed to attempt to visualize the reading process. Such a model could generate hypotheses concerning the relationship between Piagetian theory and reading acquisition of remedial readers.

The Cognitive Model of Reading Comprehension contains three components -- Developmental Stages, the Controller, and World Knowledge (see figures 1, 2). Classificational reasoning ability reflects the reader's developmental stage -- Sensorimotor, Pre-Operational, Concrete Operational, or Formal Operational. Attention, Affective Concerns, and the Self-Regulation process integrate to form the Controller. Memory, Experiences Within the Educational-Social-Physical Responsive Environment, and Metalinguistic, or print-related concepts as part of a larger Concept Grouping, form the reader's World Knowledge.

Usefulness of the Cognitive Model of Reading Comprehension is unlimited. Information from the Cognitive Model of Reading Comprehension yields a Piagetian-based definition of reading. Task analyses of word recognition and reading comprehension measures based on metalinguistic concepts in the Cognitive Model of Reading Comprehension can be accomplished. Research questions can be generated.

Research Questions Can Be Generated

The Cognitive Model of Reading Comprehension can function as the basis for generation of hypotheses about reading acquisition and reading comprehension

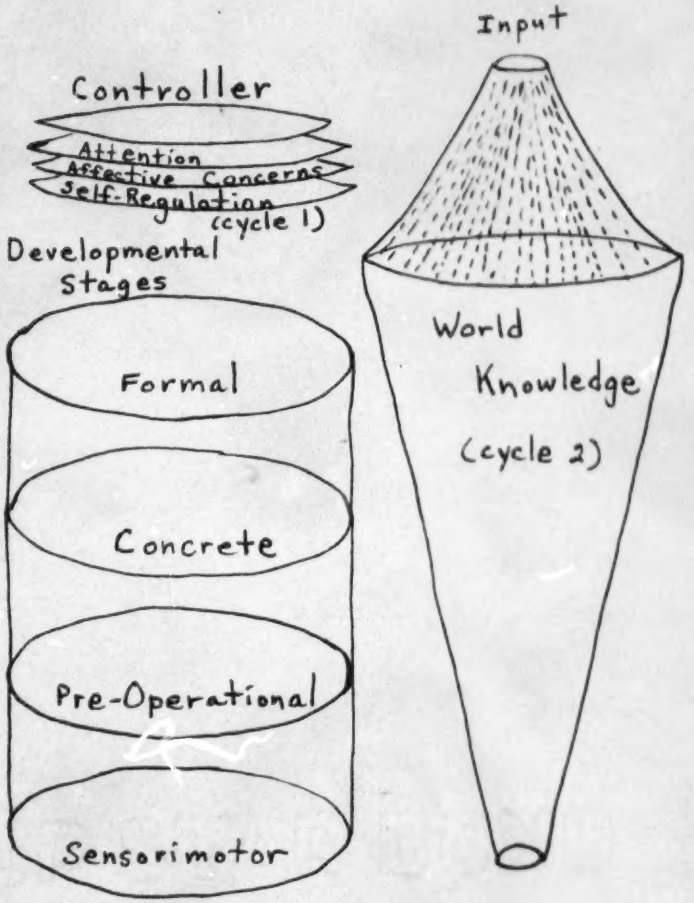
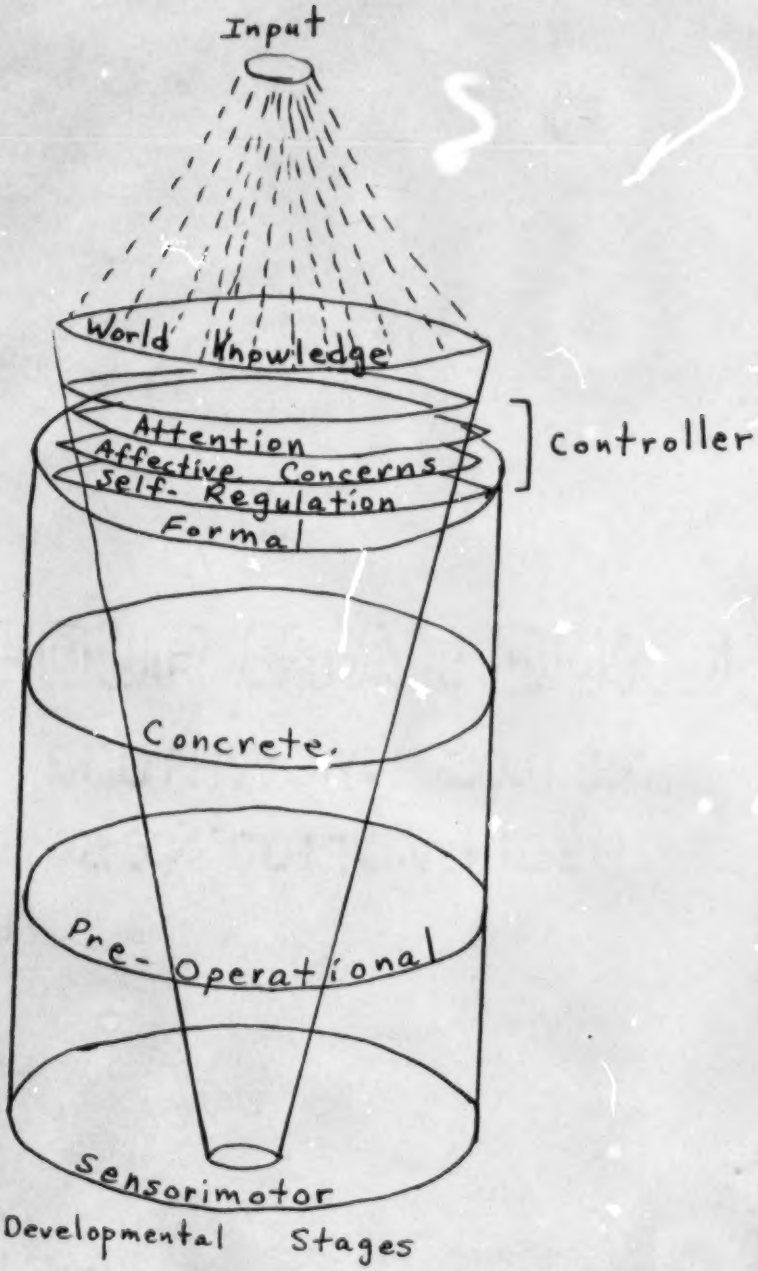


Figure 1: In the Cognitive Model of Reading Comprehension, the three interrelated components - developmental stages, controller, and world knowledge - work together. (see fig. 2).

Figure 2


Input
World Knowledge
Attention
Affective Concerns
Self-Regulation
Formal
controller
Concrete
Pre-Operational
Sensorimotor
Developmental Stages

processes. Studies suggest that classificational reasoning abilities may operate during reading acquisition.

Investigations relating reading acquisition and cognitive ability, particularly classification ability based on Piagetian measures (Garrettson, 1971; Ross, 1971; Hartman, 1977; Gillet, 1978), suggest several interesting ideas. Within a developmental classificational reasoning ability sequence, it appears that performance on "all" inclusion and ability to make superordinate groups relate to reading achievement. Measures of reading ability and classification ability appear to require both perceptual analysis and conceptual synthesis. Nonverbal and verbal performance may differ overall. No relationship was suggested between nonverbal measures of reading comprehension and classification ability. These ideas, however interesting, do not clarify the nature of the possible relationship between reasoning and reading abilities. Indeed, the need for additional research is reinforced by investigations of reading acquisition and cognitive ability.

Therefore, to examine the relationship between Piagetian theory and reading acquisition of remedial readers, focus on classificational reasoning abilities within the Cognitive Model of Reading Comprehension generated the following hypotheses: (1) There is a relationship between readers' classificational reasoning and word recognition abilities. (2) There is a relationship between readers' classificational reasoning and reading comprehension abilities.

In this study, Lowery's Classification Tasks were used to measure

development of classificational reasoning ability. Although these tasks did not include graphic print stimuli, nonverbal and verbal performance comprised the activity in that oral language, receptive and expressive, accompanied presentation of concrete objects.

While classificational reasoning ability was studied, it may be that it is part of an interrelated general reasoning ability and develops simultaneously with other skills within this ability. The Piagetian focus on classificational reasoning ability in this study was not intended to eliminate possibilities of relationships between other reasoning abilities and reading, but rather only to narrow the scope of the study.

Sample, Materials, and Design

Subjects

Subjects in this study were twenty-four second and third graders identified by their classroom teachers using a checklist based on objectives from the California Achievement Test Reading Section, and accepted into the remedial reading program after screening by the reading specialist. Subjects' ages ranged from 7.8 years to 10.9 years with a mean of 9.2 years. Twelve subjects were boys and twelve were girls. Eighteen subjects were third graders and six were second graders.

Materials and Design

In this study, data were collected using Lowery's Classification Tasks in March, 1981, and the Slosson Oral Reading Test and Silvaroli Classroom Reading Inventory in May, 1981. Lowery's Classification Tasks constituted the classificational reasoning measure. The Slosson Oral

Reading Test was used as the word recognition measure and the Silvaroli Classroom Reading Inventory as the reading comprehension measure. All three measures were administered by the investigator in separate random orderings of the twenty-four subjects.

For the purpose of this study, results of the Lowery Classification Tasks were quantified as follows. Lowery's Classification Tasks include preclassifying abilities of (1) Resemblance Sorting -- 3 points, and (2) Consistent and Exhaustive Sorting -- 3 points; true classifying abilities of (3) Multiple Membership Classifying -- 5 points, and (4) Inclusive Classifying -- 6 points; flexibility in classifying with (5) Horizontal Reclassifying -- 7 points, and (6) Hierarchical Reclassifying -- 3 points.

The Resemblance Sorting Task consisted of showing the subject three sets of eight objects. For each of the three sets, the subject was shown one object and asked to select the other object most similar to it in the set. Objects were matched on the basis of shape, color, and size. Subjects were asked to state reasons for their choices. Two of three correct responses indicated that subjects were at or beyond the Resemblance Sorting level.

The Consistent and Exhaustive Sorting Task consisted of directing the subject to perform three complete sortings of a set of twelve objects, then to state the common trait for each sorting. Correct responses were based on shape, color, and size.

The Multiple Membership Classifying Task consisted of two parts, in

which sets of objects and yarn loops were used as the basis for questions concerning class membership of objects. In part one, subjects responded to questions and justified groupings concerning class membership of objects. Three of four correct responses indicated that subjects were at or beyond the level of Multiple Membership Classifying. In part two, rules for yarn loops were given and subjects were asked to place objects within loops according to rules. Correct placement of objects and explanation demonstrated that subjects comprehended simultaneous attributes of objects.

The Inclusive Classifying Task consisted of presenting subjects with a collection of objects, asking six class inclusion questions related to the objects, and requesting justification for responses to questions.

The Horizontal Reclassifying Task consisted of presenting subjects with a set of seven objects. As each of the seven objects was removed from the group, the subject was asked to supply the common attribute for the six remaining objects. Generally, negative statements were not acceptable responses. Five of seven correct responses indicated that subjects were able to perform Horizontal Reclassification.

The Hierarchical Reclassifying Task consisted of presenting four groups of objects with directions to form three groups, then two groups, then one group, and to state justification for each grouping. Two of three correct responses indicated that subjects were able to perform Hierarchical Reclassification.

The Slosson Oral Reading Test (1963), used as the word recognition

measure, consists of ten lists of twenty words. During individual sessions, subjects were asked to pronounce increasingly difficult lists of words. Standard directions given for the SORT were followed by the investigator. Raw scores were transformed to grade equivalents according to the table accompanying the test.

The Silvaroli Classroom Reading Inventory Form B (1973) was used to measure reading comprehension. The Silvaroli consists of Graded Word Lists to determine the approximate starting level for Graded Oral Paragraphs. In individual sessions, students read Graded Oral Paragraphs and answered comprehension questions according to standard directions in the manual. The ten possible reading levels were Preprimer, Primer, 1, 2, 3, 4, 5, 6, 7, and 8.

Relationships between classificational reasoning and word recognition abilities and between classificational reasoning and reading comprehension abilities were explored through correlational analyses. The Pearson Product-Moment correlation coefficient was used as the correlational measure.

Coefficients were computed with the following data: (1) Number of levels of Lowery Classification Tasks performed successfully; (2) Slosson Oral Reading Test grade equivalents, measuring word recognition ability; (3) Silvaroli Classroom Reading Inventory total Graded Oral Paragraphs read at Independent and Instructional levels, measuring reading comprehension.

Statistical significance of the correlation coefficients was tested applying the distribution of t (Ferguson, 1976). Level of statistical

significance for a one-tailed test of the critical values of t were obtained.

Results

While performing the Classification Tasks, thirteen of twenty-four subjects achieved Resemblance Sorting and showed evidence of Multiple Membership Classifying even though they could not perform the Consistent and Exhaustive Sorting Task thoroughly and completely.

Table 1 shows the means, standard deviations and range of test results for classificational reasoning, word recognition, and reading comprehension. The mean Classificational Reasoning Ability score was 1.21 with a range from 0 to 4, SD = 1.02. The mean Slosson Oral Reading Test score was grade equivalent 3.13 with a range from 1.5 to 4.6, SD = 0.75. The mean Silvaroli Classroom Reading Inventory score was 3.54 with a range from 1 to 7, SD = 1.61. In other words, the mean reading level score on the Silvaroli was between reading grade levels 1 and 2, with a range from Preprimer to reading grade level 5.

TABLE 1

Means, Standard Deviations, and Ranges of Test Results

Tests	N	$\bar{X}$	SD	Range
Lowery's Classification Tasks	24	1.21	1.02	0-4
Slosson Oral Reading Test	24	3.13	0.75	1.5-4.6
Silvaroli Classroom Reading Inventory	24	3.54	1.61	1-7

Table 2 shows the Pearson Product-Moment correlation coefficients between (1) classificational reasoning and word recognition abilities and (2) classificational reasoning and reading comprehension abilities and statistical significance of the coefficients.

TABLE 2

Correlation Coefficients
and Tests of Significance

Variables	N	Pearson r	t-ratios	Significance Level
Classificational Reasoning with Word Recognition	24	.20	.957	$p > .05$
Classificational Reasoning with Reading Comprehension	24	.38	1.92	$p < .05$

Classificational Reasoning: Lowery Classification Tasks, Number of levels performed successfully

Word Recognition: Slosson Oral Reading Test, Grade equivalents

Reading Comprehension: Silvaroli Classroom Reading Inventory, Total graded oral paragraph levels read at independent and instructional levels

Findings suggest that classificational reasoning and word recognition abilities were slightly correlated in an almost negligible positive relationship ($r = .20$). Results of a one-tailed t test indicate that this correlation was not statistically significant ($t = .957$, $df = 22$, $p > .05$).

Classificational reasoning and reading comprehension abilities were definitely correlated in a small positive relationship ($r = .38$). Results of a one-tailed t test indicate that this correlation was statistically significant ($t = 1.92$, $df = 22$, $p < .05$).

Using r^2 to predict from these correlation coefficients, the coefficient of determination provided a direct estimate of the shared variance of each of the pairs of variables, yielding information related to the magnitude of correlation (Williams, 1968). Thus, four percent of the variance is shared by classificational reasoning and word recognition abilities. Fourteen percent of the variance is shared by classificational reasoning and reading comprehension abilities.

Discussion

Two hypotheses were investigated in this study. The first dealt with the relationship between classificational reasoning and word recognition abilities, and the second with the relationship between classificational reasoning and reading comprehension abilities.

In the Cognitive Model of Reading Comprehension (Foltz, 1981), the importance of classificational reasoning ability is emphasized. As part of a general developmental reasoning ability affecting application of

metalinguistic concepts, classificational reasoning may affect performance on the measures used in this study.

In the classification schema featuring metalinguistic concepts, task analysis based on the Cognitive Model of Reading Comprehension suggests that the Slosson Oral Reading Test may capitalize on tacit knowledge of Concepts of Reading, Word, Letter (letter features and visual features), Sound (including pronunciation elements), and Directional Concepts. In addition to these, the Silvaroli Classroom Reading Inventory may capitalize on Concepts of Sentence and Content-Form of Message.

In the present study, when second and third grade remedial readers performed classificational reasoning, word recognition and reading comprehension activities, results indicate that classificational reasoning and reading comprehension activities were more closely related than classificational reasoning and word recognition activities. The percentage of shared variance between classificational reasoning and reading comprehension ability suggests that metalinguistic knowledge may be more applicable to reading comprehension than to word recognition activities. However, it is possible that the higher correlation may be a function of the questioning formats of both measures.

An implication suggested by this study's findings contributes to examining the validity of Lowery's Classificational Reasoning Tasks as a predictor of reading comprehension ability in elementary remedial readers. However, future research with random samples from a normal range of elementary readers may not reveal differences in the correlations between classificational

reasoning, word recognition, and reading comprehension abilities for above average readers. Better readers may perform equally well with word recognition and reading comprehension activities.

At this time, the research design and results of this study do not appear to lend support for training in logical abilities to facilitate reading comprehension ability. However, findings do not discourage interest in the relationship between logical abilities and reading acquisition. Research based on the Cognitive Model of Reading Comprehension is needed to develop a broader knowledge base for development of materials and instructional practices.

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